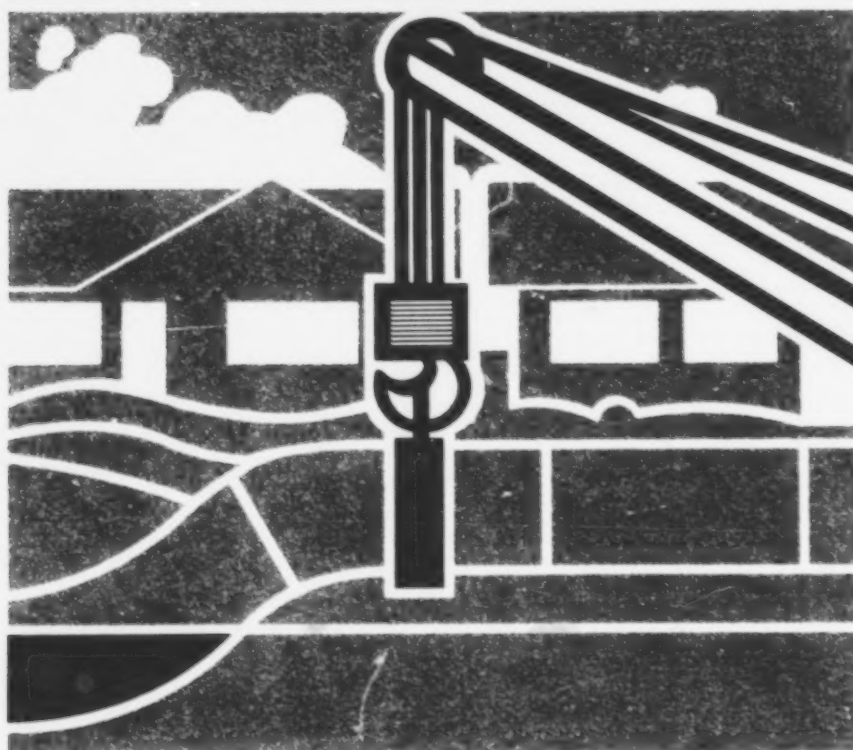


ADVISORY LAND USE PLANNING NOTES
ON THE
PIPELINE-URBAN
ENCROACHMENT
PROBLEM



MARCH, 1986

**Advisory Land Use Planning Notes on the
Pipeline-Urban Encroachment Problem**

The development of energy resources is important to Alberta's economy but it also has significant impact on land use and development. An example of this is when urban development engulfs oil and gas transmission pipelines. This creates safety concerns and potential land use conflicts.

Alberta Municipal Affairs, recognizing the importance of the pipeline-urban encroachment problem, and in conjunction with other provincial agencies, municipal and regional planning authorities and private industry, has developed the attached advisory land use planning notes to address the issue.

The information contained in these notes is not government policy. However, the advisory notes have been reviewed by the Alberta Planning Board and endorsed by this Department as technical advice to municipal and planning authorities. The notes should serve as a stimulus, enabling the concerned agencies to address issues associated with the encroachment problem.

Alberta Municipal Affairs and the Alberta Planning Board encourage municipalities to include provisions in their statutory plans and land use bylaws to address the pipeline-urban encroachment problem. I believe that these advisory notes will assist the formulation of municipal provisions concerning this issue.



Archie Grover
Deputy Minister

March 1986

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

SECTION I: ADVISORY LAND USE PLANNING NOTES ON THE PIPELINE-URBAN ENCROACHMENT PROBLEM

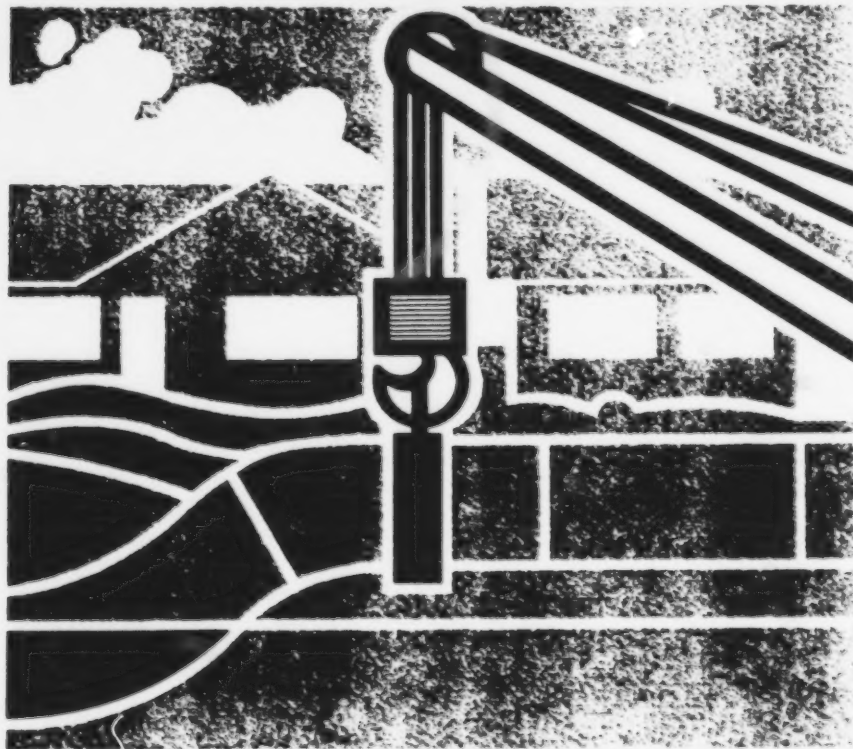
I.	Introduction_____	1
II.	Subdivision and Urban Design Planning Notes_____	5
	1. Use of the Pipeline Right-of-Way_____	5
	2. Adjacent Land Uses and Development Setbacks_____	8
	3. Access_____	11
	4. Identification_____	12
III.	Operational Planning Notes_____	13
	1. Replies under Interim Directive 81-4_____	13
	2. Land Use Planning Agency Participation in ERCB Hearings_____	14
	3. Pipeline Location Data Bases_____	14
	4. Consultation with Pipeline Operators_____	15

SECTION II: TECHNICAL SUPPLEMENT

I.	Introduction_____	17
II.	An Overview of the Pipeline-Urban Encroachment Problem_____	18
III.	ERCB Initiatives_____	22
IV.	Land Use Planning Issues_____	24
	1. Urban Fringe_____	24
	2. Land Use Planning Agency Participation in ERCB Hearings_____	25
	3. Subdivision Referrals and Consultation with Pipeline Operators_____	26
	4. Data Bases on Pipeline Location_____	27
	5. Pipeline Relocation_____	27
	6. Development Setbacks_____	30
	7. Urban Design_____	31

SECTION 1

**ADVISORY
LAND USE
PLANNING NOTES**



SECTION I: ADVISORY LAND USE PLANNING
NOTES ON THE PIPELINE-URBAN
ENCROACHMENT PROBLEM

I. INTRODUCTION

1. Origin

In 1979, a pipeline ruptured and endangered a large area in Edmonton's Millwoods area. The Energy Resources Conservation Board (ERCB), in its inquiry report, recognized that proper planning of land use around pipelines was essential and called for a concerted effort to deal with the issue. Since then, various interested parties, both private and governmental, have been involved in various capacities in exploring the issues and developing solutions. The advisory notes are the culmination of the efforts that dealt with the land use planning perspective.

2. Purpose

The Alberta Planning Board's Framework for Application of Regional Plan Guidelines provides guidance on the contents of regional plans. The Framework requires regional plans to define and protect regionally-significant utilities from encroachment, and to provide direction to municipalities on policy implementation. To date, regional plans have provided general policies in this respect. The objective of the advisory land use planning notes contained in this document is to provide additional information for consideration by regional planning commissions and municipalities. The planning notes would rely upon the exercise of municipal planning prerogatives for their implementation. As such, the planning notes could be incorporated, at the discretion of municipalities, with modifications, depending on local circumstances, into the appropriate statutory planning documents and the land use by-law.

Since pipelines are exempt from the Planning Act, land use planning agencies do not have lead roles in the pipeline approval process. However, planning agencies do have jurisdiction in such matters as prescribing uses on and adjacent to pipeline right-of-ways (ROWs) and establishing appropriate setbacks for structures adjacent to ROWs. Also, land use planning agencies can present their concerns and recommendations on the location of pipelines during the ERCB's approval process.

More specifically, the purpose of the planning notes is to:

- encourage co-operation among land use planning authorities, the urban development industry, the ERCB, and pipeline operators to prevent pipeline-urban encroachment problems from developing;
- assist municipalities and regional planning commissions in accommodating and mitigating development constraints imposed by pipelines; and
- inform public officials, planners, and development officers about the various aspects of pipeline-urban encroachment problem and the various measures that can be implemented to deal with it.

3. Scope of the Pipeline-Urban Encroachment Problem

In general, the pipeline-urban encroachment problem results from the location of pipelines in close proximity to urban municipalities. Once urban development engulfs the pipelines, two key concerns arise:

- safety - how to ensure that the existence of the pipelines will be compatible with the land uses on and adjacent to the ROW.
- land use conflicts - how to integrate the pipeline ROWs with urban development in order to minimize fragmentation of land uses and reduce development costs.

The pipeline-urban problem is not a single "problem" or "issue". Some of the specific problems are as follows:

- In certain instances, there is no municipal or regional planning commission participation in the ERCB approval process. Since a land use planning perspective is not consistently brought to the attention of the ERCB, it may result in pipelines being constructed in areas that ultimately become subject to urbanization. During the urban development phase, pipeline companies which operate "hazardous" pipelines incur additional costs by having to upgrade their lines retroactively to higher safety standards. Developers incur expenses by realigning pipelines for more efficient subdivision, designing and servicing subdivisions around existing pipelines, and by providing additional setbacks which entails a reduction in the total developable area.
- Land use planning agencies frequently have an insufficient understanding of the safety implications of pipelines and as a result set arbitrary setbacks that are either too, or not sufficiently, restrictive; and permit inappropriate adjacent land uses.

- Land use planning agencies may not be aware of the location of pipelines and this may lead to increased risks of third-party damage, obstructed access to pipeline ROWs for maintenance and emergency response purposes, and the encroachment of structures onto the pipeline ROWs.
- The opportunities for integrating pipeline ROWs with the urban fabric have not always been recognized. The ROWs have the potential for multiple uses, as for example, a buffer zone to separate incompatible land uses, and passive and active recreational uses.

Many of the above problems and difficulties can be resolved by the judicious use of the advisory land use planning notes.

4. Organization of Document

The document is presented in two sections: advisory land use planning notes and a technical supplement.

The planning notes deal with subdivision and urban design principles and operational matters.

Specifically, the subdivision and urban design planning notes deal with such issues as the use of pipeline ROWs, appropriate adjacent land uses, development setbacks, and visual appearance and access to pipeline ROWs. The operational planning notes deal with such matters as land use planning agency participation in the ERCB pipeline approval process, consultation with pipeline operators, and the use of pipeline location data bases.

Provided under each planning note is a brief elaboration of its intent, as well as an explanation as to the reason why it is provided.

The second section of the document contains a technical supplement. The purpose of the supplement is to provide additional detail on a range of matters relating to pipelines and land use. It is intended primarily for the more technically oriented, as well as those wishing a more detailed analysis of the issues. Because of the discussion which is provided under each planning note, the first section of the report can be viewed as being self-contained.

5. Clarification of Terms

Provided below is a clarification of the key terms found in the planning notes and technical supplement.

ERCB INTERIM DIRECTIVE (ID) 81-4. Under the ID, the ERCB requires an applicant for a pipeline permit to include in the application, a statement that the applicant has advised the urban municipality of the intent to apply to construct a pipeline, and whether or not the municipality has any objections to the application. The requirement applies to proposed pipelines within 1.5 km of the corporate limits of an urban municipality, but does not include gas distribution lines that will operate at a pressure of 700 KPa or less.

HIGH VAPOUR PRESSURE (HVP) PIPELINE. A pipeline transporting hydrocarbons or hydrocarbon mixtures in the liquid or quasi-liquid state with a vapour pressure in excess of 240 KPa at 38° C. At atmospheric pressure, the hydrocarbons exist in a vapour state and are heavier than air. Substances which are transported as a liquid under pressure through HVP pipelines include ethane, ethylene, propane, butane, and natural gas liquids which are mixtures of ethane, propane, butane and condensate.

PIPELINE. Any portion of the network of pipelines designed to transmit oil, gas, and other products from wells to storage facilities, refineries, processing plants, and to distribution centres. The definition excludes distribution systems operated for product delivery to consumers, which are defined as "utilities" and "public utilities" under the Planning Act.

RIGHT-OF-WAY (ROW). The strip of land in which a legal right of passage is granted over another person's property. This right can be acquired by means of an easement or by a right of entry order.

A pipeline operator acquires an easement for the construction, operation, protection, surveillance, and abandonment of the pipeline. The landowner retains the right to use the easement as long as it does not interfere with activities associated with the pipeline or its integrity. For this reason, a typical easement agreement requires the landowner to obtain the consent of the pipeline operator to disturb the ground or to erect a structure.

As such, the rights acquired by an easement recognizes that the operation and maintenance of the pipeline is the prime function, and that the residual rights are available to the surface owner during the existence of the pipeline.

When an operator is unable to obtain a signed easement from the surface owner, an application can be made to the Surface Rights Board for an order granting right of entry. An order would indicate the width of the ROW and the rights granted to an operator.

SOUR GAS. By definition, sour gas contains more than 1% hydrogen sulphide (H₂S). Sour gas is toxic. Since the H₂S concentration in sour gas varies, so too does the risk to the adjacent population.

II. SUBDIVISION AND URBAN DESIGN PLANNING NOTES

The notes presented below, except where specifically discussed, are equally applicable to all types of product pipelines. However, in view of the potential hazard of sour gas, high vapour pressure pipelines, and large diameter-high pressure hydrocarbon pipelines; greater precautionary measures should be considered to protect their integrity.

1. Use of the Pipeline Right-of-Way

Where pipeline abandonment is not envisaged, surface land uses on the pipeline ROW should be safely, functionally, and visually integrated with adjacent development.

The pipeline ROW should be incorporated into the subdivision since it is an important spatial element. The pipeline ROW can be used for park and open space purposes (e.g., playing fields, walkways, bicycle paths, golf courses) in the subdivision. Where the pipeline is used as a walkway, consideration should be given to developing, where feasible, pedestrian attractions, located at either end or along its course, such as a park, recreation or local commercial centre.

Landscaping of the pipeline ROW could include: contouring, construction of earth berms, walkways or bike paths. It should promote recreational use and be integrated with adjacent land uses by extending the landscaping along linking walkways. Trees and shrubs should be located at a distance from the centre-line of the pipeline ROW since they could impede access and deep-rooting vegetation could cause damage to the pipeline.

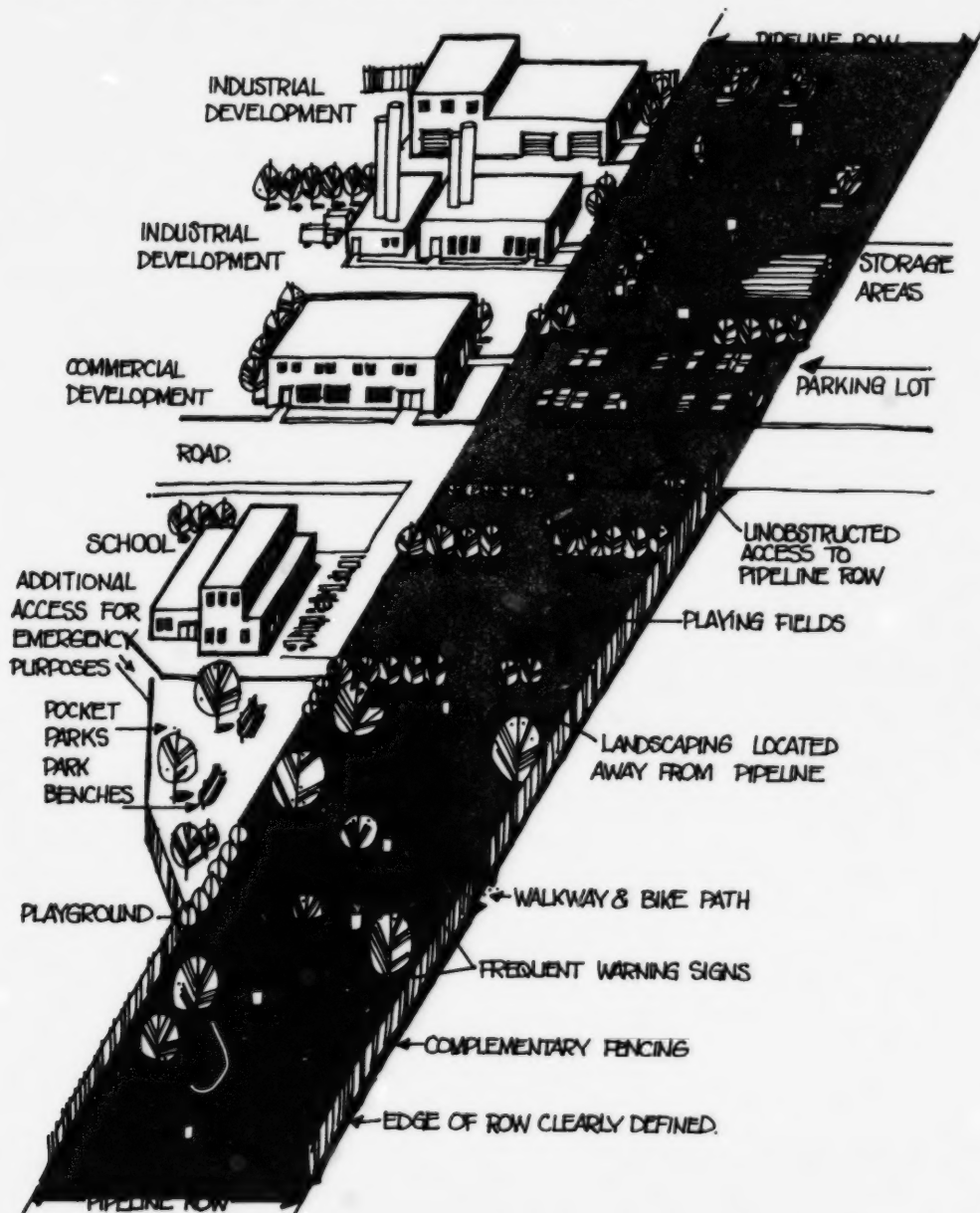
The attractiveness of the pipeline ROW could be enhanced by encouraging the development of small pocket parks along its length. Also, appropriately designed fences can improve the appearance of the ROW and help integrate the ROW with the subdivision.

Similar treatment of ROWs in commercial and industrial subdivisions may be provided if there is a potential for the ROWs to form part of a larger park system.

Alternatively, the pipeline ROW could be used as a buffer to separate different land uses; for example, to form part of the berming requirements or noise attenuation measures for developments adjacent to arterial roadways, major highways, or railways.

In industrial and commercial subdivisions, the pipeline ROWs can be used for parking or storage purposes as long as the objects can be readily moved for rapid access in the event of an emergency, and are compatible with loading restrictions over pipelines.

If ground disturbances or surface uses are contemplated for a ROW, it is important that contact be made with the pipeline company to ensure that any concerns with respect to pipeline integrity are appropriately incorporated. The standard easement agreement requires consultation prior to any ground disturbances or surface uses by the landowner. Pipeline companies will support surface uses which do not jeopardize the integrity of the pipeline. For this reason, provisions in an easement agreement can be renegotiated and relaxed should it be necessary.



1.1 INTEGRATION OF PIPELINE ROWS

BACKGROUND

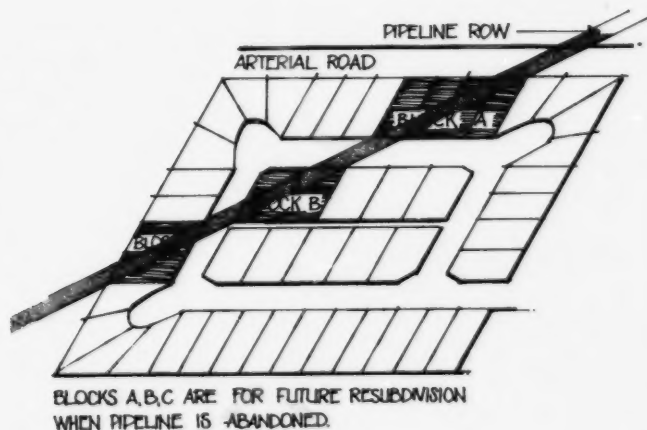
In many instances, land use planning authorities have not given adequate recognition to the opportunities for integrating pipelines safely and functionally with adjoining land uses. There are a number of functional and aesthetic uses which a ROW could serve in an urban environment, while at the same time ensuring the long-term protection of a pipeline. A number of the uses are shown on sketch 1.1.

In areas where abandonment of the pipeline is envisaged in the near future, the pipeline ROW should be wide enough to permit its future redesign.

An example would be to design roads and lots within the ROW so that when the pipeline is abandoned, the subdivision can be completed. This planning principle can realistically be applied only in a minority of cases, in part because the service life of pipelines can extend at least forty years. This principle should only be implemented if it is supported by the developer, who is in the best position to evaluate the economic feasibility of such an approach.

BACKGROUND

The design of most existing subdivisions does not provide an expedient way to reuse the ROW, if a pipeline is abandoned. In most cases, the only way that a use other than a walkway or recreational use could be made of the ROW is if, either the adjacent lot boundaries are extended to include the ROW, or a replotting scheme is adopted to create more lots. The former alternative would not always be acceptable in residential subdivisions because of the width of the ROW, while the latter alternative may require the demolition of existing structures to accommodate the design. In addition, both alternatives would be difficult to implement because of the large number of land owners that would be involved. Thus the ROW could remain in place, with the associated maintenance costs, even though the pipeline has been abandoned. The manner in which the principle of future redesign could be implemented is illustrated below.



1.2 REDESIGN OF PIPELINE ROWS

No structures should to be constructed on the pipeline ROW.

The planning principle includes permanent and temporary structures within pipeline ROWs which would prevent proper inspection and maintenance of the pipeline, and which would limit access and emergency working space around pipelines, but does not encompass such structures as walkways and roadways.

BACKGROUND

One method by which the long-term protection of a pipeline might be assured is to ensure that buildings and other structures are located outside the perimeter of the pipeline ROW. Structures within pipeline ROWs would prevent proper inspection and maintenance of the pipeline, increase the possibility of third-party damage, and limit emergency access and emergency working space around pipelines. Although neither the Pipeline Act nor the Planning Act prohibit structures on pipeline ROWs, it is standard procedure for easement agreements to require the landowner to obtain the consent of the easement holder to erect a structure on the ROW. However, there is frequently inadequate enforcement over the pipeline easement by the pipeline operator or the municipality, because to monitor the use activities of individual land owners on the ROWs would require substantial manpower.

2. Adjacent Land Uses and Development Setbacks

Buildings housing social service functions, or providing emergency services and essential infrastructure in the event of a pipeline failure or rupture, should be located a minimum distance of 200 metres away from high vapour pressure pipelines, and any hydrocarbon pipelines with an outside diameter equal to or greater than 324 mm (12 in.) and an operating pressure equal to or greater than 3475 KPa (500 psi). For other land uses adjacent to these types of pipelines, the minimum setback should be the edge of the pipeline ROW, or 5 metres from the centre-line of the pipeline, whichever is greater.

Examples of the types of buildings for which the 200 metre setback would be applicable include:

- . Hospitals and associated institutions for the physically and mentally handicapped
- . Senior Citizen Homes
- . Nursing Homes
- . Penal Institutions
- . Telephone Exchange Installations
- . Power Installations
- . Water Pump Stations
- . Police Stations
- . Fire Halls

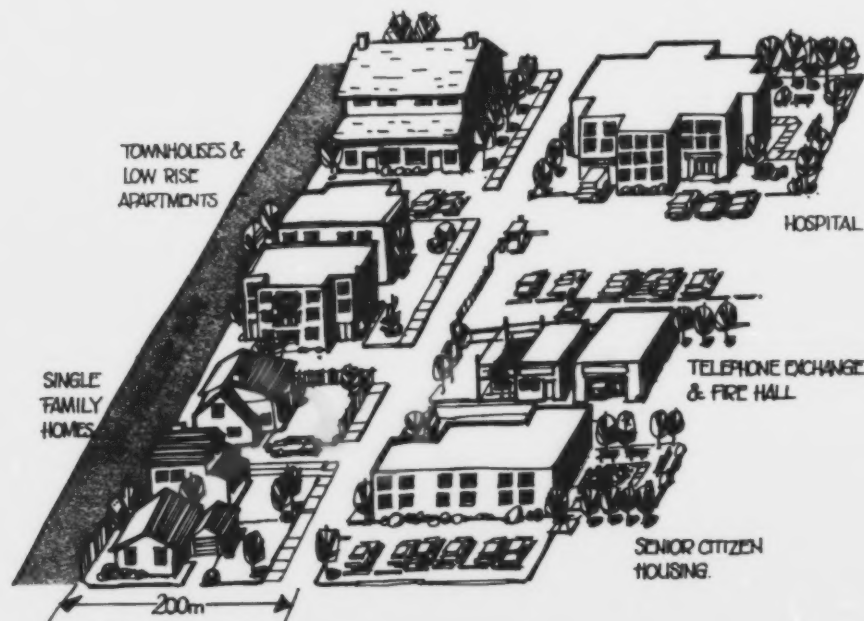
Otherwise, a wide range of land use and densities should be permitted to locate adjacent to pipeline ROWs. Higher density developments can make better use of the open space provided by the ROW, as well as permit greater flexibility in specific site designs and in the location of buildings. The setbacks should be measured from the closest point of any part of a building or structure, regardless of whether it is above or below ground level.

BACKGROUND

The list of buildings and land uses provided above represent a concern either because they pose a difficulty in terms of immediate evacuation or because they are an important component of any disaster services evacuation plan. Destruction or evacuation of the buildings housing emergency-related services would cause an interruption in the emergency service, compounding the emergency situation.

In general, the minimum distances are at best a rule-of-thumb. However, the ERCB's Inquiry Report (D83-F) **Resource Development/ Urban Development: West Edmonton Area** suggests that the 200 metres and 5 metres should be considered as the minimum setback distances in their respective cases. Prevailing winds, pipeline design, and age of pipeline may require altering this distance.

A basic premise in establishing the separation distances is that pipeline ROWs should be clear of any development or construction. The rationale for selecting the types of buildings and pipelines where a 200 metre setback would be applicable is based on the additional time required for evacuating occupants, and the potential explosion and fire hazard. This is illustrated below.



21 DEVELOPMENT SETBACKS

For cases not identified in the previous planning principle or in the Subdivision Regulation, municipalities should incorporate into their municipal planning documents distance separation provisions between the pipeline and any adjacent buildings and structures which are based on a number of criteria.

Because of the toxicity of sour gas, the Subdivision Regulation stipulates minimum distance requirements separating sour gas pipelines from residential and other developments.

It is not possible to determine a single minimum setback which would be applicable to all situations. The basic reasons for requiring setbacks between buildings and the pipeline are to prevent third-party damage to pipelines, to avoid the extension of particular uses beyond the boundary of the lot, and to provide enough space for vehicle movement during construction or in the event of an emergency. Municipalities, however, should recognize that not all pipelines will have the same level of risk, nor magnitude of impact on adjacent properties in the event of a rupture or failure. Pipeline design (e.g., depth of burial, diameter, wall thickness); the type of product a pipeline carries; the operating pressure of a pipeline; and the nature of adjacent land uses all play an important part in determining the nature and level of risk involved, and therefore the necessity for a particular setback distance.

Municipalities should be sensitive to the development costs associated with the setback requirements they choose to implement, and therefore should not require a greater setback than the situation warrants.

BACKGROUND

Land use planning authorities frequently view setbacks as the primary means of reducing risks to adjacent populations, and they may not be aware that additional requirements may have already been imposed by ERCB on "hazardous" pipelines traversing urban environments. These technical requirements may include deeper burial of pipelines, reduction of operating pressure, increasing the wall thickness of the pipeline, and the installation of additional block valves at closer spacing to reduce the amount of product that would escape if a break or rupture occurred.

There are also various land use measures, other than setbacks, which can be utilized to limit safety concerns such as: controlling adjacent land uses, providing access to the ROW for emergency purposes, controlling surface uses on the ROW, and increasing the frequency of warning signs.

Setback distances should be established in the context that setback distances are only one of a number of land use measures which can be implemented to limit risks. In turn, land use measures are only one of a number of means of reducing risks to adjacent populations.

3. Access

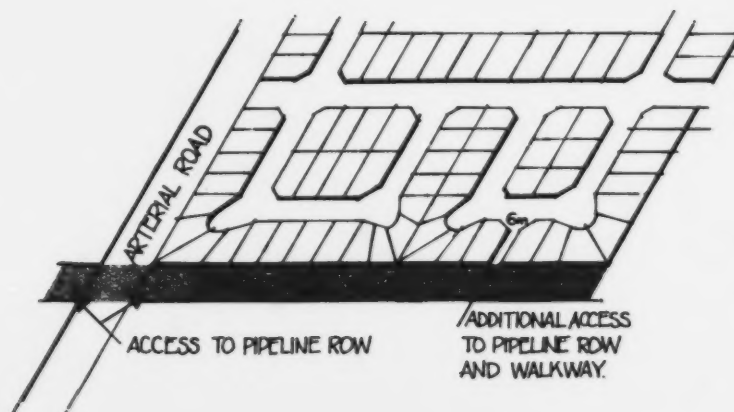
The pipeline ROW should not be obstructed, and vehicular access should be provided to the pipeline ROW.

At designated intervals, site design and layout of buildings adjacent to pipeline ROWs should provide unobstructed access to the ROW, unless adequate access can be provided at road crossings.

The pipeline ROW could be used for storage, or parking, where the stored item or parked vehicles can be quickly removed during an emergency situation. Obstruction of the pipeline ROW with large heavy equipment, or heavy industrial storage should be avoided because it would pose a serious problem if the materials have to be removed. Any type of storage with an explosive potential and some types of storage and activities such as truck traffic which can impose excessive stress loadings on the pipeline, loadings which were not considered in the design of the pipeline, should not be permitted.

BACKGROUND

It is necessary to provide access to, and within, pipeline ROWs for a number of purposes including pipeline maintenance and for emergency containment and repairs. Furthermore, to ensure the safety of the adjacent population, the integrity of the pipeline must be protected by restricting surface uses of the ROW. The principle of adequate access is conceptually presented below.



3. ACCESS TO PIPELINE ROWS

4. Identification

The pipeline should be appropriately signed for easy identification.

Municipalities should supplement the requirements of the Pipeline Regulations by installing warning signs at more frequent intervals, particularly in areas that are undergoing urban development, and in areas experiencing a greater intensity of other construction activity.

An initiative to minimize third-party damage should be given consideration by municipalities. For example, an agreement was reached between the City of Calgary and all of the pipeline companies within its boundaries, to increase the frequency of pipeline warning signs for all pipelines (except distribution lines). The program was voluntary as all the pipeline companies recognized the need. The pipeline companies carried the costs for the signs and the installation. The standard warning signs, as provided in the Pipeline Regulation, were placed at 300 meter intervals, or closer in such instances as roading crossings or where the direction of the pipeline deviated.

BACKGROUND

The Pipeline Regulations require pipeline companies to erect pipeline warning signs at each side where a pipeline crosses a highway, road, railway or watercourse. The Regulations also require that pipelines that transport high vapour pressure products in urban areas have warning signs at such intervals that will continuously mark their location. At present, no additional signage requirements are in place for large diameter (324 mm or greater) and high pressure (3475 KPa or greater) hydrocarbon pipelines, even though they are in the same broad hazard level category as HVP pipelines.

In urbanized areas, there is a greater intensity of construction activity which leads to a greater probability of third-party damage. A pipeline is intrinsically safe as long as there is adequate control over third-party damage. If warning signs are appropriately placed and maintained within the pipeline ROW, the chance of the pipeline being damaged during construction activity will be significantly lessened.

III. OPERATIONAL PLANNING NOTES

The planning notes provided below deal primarily with matters that relate to consulting with, or providing land use planning information to, other actors involved in the encroachment issue.

1. Replies Under Interim Directive 81-4

Urban municipalities should include provisions in their general municipal plan which would provide guidance (i.e., procedures and criteria) on how to deal with pipeline application referrals to the municipality. Municipalities are encouraged to take an active role in replying to, and negotiating with, the pipeline company. In cases where internal expertise is unavailable, the regional planning commission should be consulted.

In replying to a pipeline company's referral, the municipality should review existing land use and prevailing development trends, identify lands with future development potential and assess the timing of development. From this process, the municipality should be able to identify sections of the proposed route(s) which will and may (depending on the growth scenarios) pose a future encroachment problem and other land use concerns. The reply should be as specific as possible.

Should a municipality decide that it is in its best interest to suggest a preferred route, the following broad planning considerations should be utilized:

- compatibility with statutory plans and land use designations, and the anticipated direction of urban growth;
- minimal conflict with existing and proposed subdivisions and a suitable distance from existing and planned urban land uses; and
- level of land fragmentation.

Certain circumstances (e.g., financial, location of wells and existing infrastructure) may require that the proposed pipeline traverse areas that will be subject to urbanization. In such a case, the municipality should negotiate with the pipeline company to minimize potential conflicts. As a first step, the municipality should assess whether:

- the pipeline ROW can be combined with existing or planned utility or transportation corridors, or incorporated with an existing pipeline ROW;
- the pipeline ROW could form a functional component of an open space system or a buffer between incompatible uses; and
- the pipeline ROW would limit adjacent land uses, or alternatively complement or enhance adjacent land uses.

BACKGROUND

Under the Interim Directive, the ERCB requires the pipeline applicant to contact the urban municipality to determine whether or not the municipality has any objections to a proposed pipeline located within 1.5 km of the municipal boundary. Should an urban municipality have an objection to the routing of a pipeline, the ERCB will provide assistance in negotiating a route which would accommodate municipal concerns. Thus it is important that the municipality reply; otherwise the process to resolve the issue is not initiated. However, to date, municipalities frequently have not made the effort to provide pipeline applicants with their position. The consequence is that many pipelines become haphazardly aligned from an urban development perspective, resulting in land fragmentation and other problems for future urban growth.

2. Land Use Planning Agency Participation in ERCB Hearings

Land use planning agencies should make a representation at an ERCB hearing if any of the proposed pipeline routes could pose an encroachment problem.

The ERCB's procedure requires that written submissions be filed with it prior to the hearing. In making a written submission, the land use planning agency should state its position and concerns, and the reasons for those concerns. The submission should be specific.

If none of the alignments proposed by the pipeline operator are acceptable, planning agencies should endeavour to assist the ERCB by suggesting other reasonable alternatives. Since certain considerations may require a pipeline to traverse areas of future urban expansion, planning agencies should, when appropriate, also provide information on measures and routes which would minimize land use conflicts.

BACKGROUND

It is important that land use planning authorities participate in the hearing process because the ERCB is required to base its decision on the evidence that is presented, and it enhances the ERCB's information on matters upon which it must render a decision. However, planning authorities do not participate in the hearings regularly, and as a result, land use issues are not fully brought to the attention of the ERCB.

3. Pipeline Location Data Bases

Pipeline location data bases should be utilized for a range of planning purposes.

Land use planning authorities are encouraged to obtain from the ERCB the relevant pipeline township drawings. This would enable the planning authorities to: identify the pipeline operators (for purposes of developing contact lists); identify the approximate location of pipelines; determine whether or not the pipelines are transmitting hazardous products; and identify instances where referrals to the ERCB should be made.

BACKGROUND

Although pipeline township drawings serve a range of useful purposes, only a very limited number of planning authorities have requested the drawings from the ERCB to date.

4. Consultation with Pipeline Operators

To expedite the subdivision approval process, the developer should be encouraged to consult with the pipeline operator with respect to the safety implications of the pipeline prior to any formal applications to land use planning agencies. Municipalities should also consult with the pipeline operator during the preparation of statutory plans so that the pipeline ROW can be integrated with future urban development.

This planning principle recognizes that pipeline safety is an important factor and must be taken into consideration in designing a subdivision or in preparing statutory plans. The planning principle also seeks to ensure that bottlenecks do not develop in the approval process as a result of a lack of awareness of the location and safety implications of pipelines.

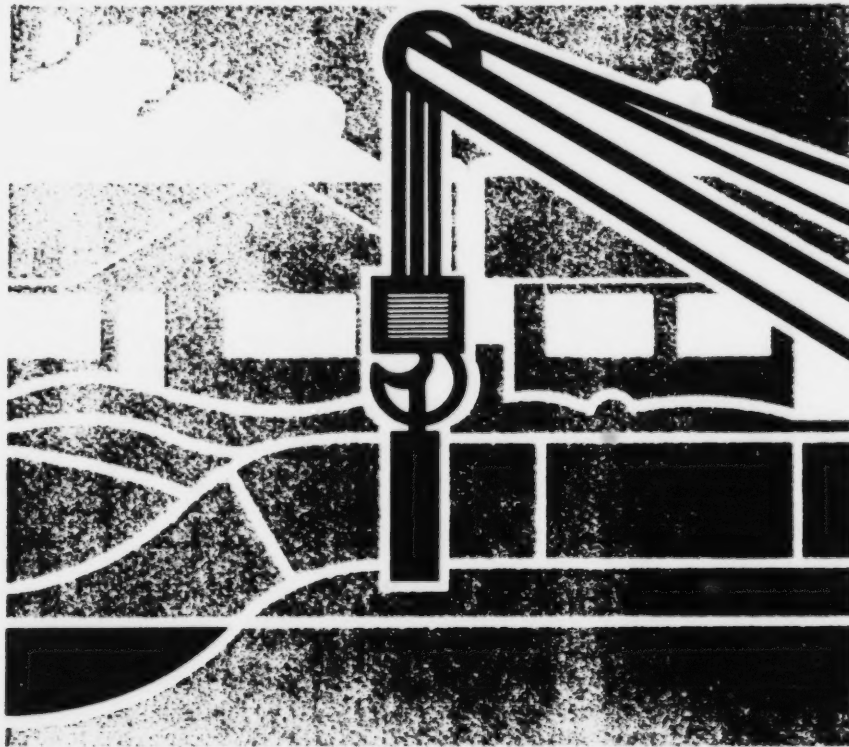
BACKGROUND

In the majority of cases, no "as-built" drawings are available which would provide information on such matters as the exact location of a pipeline within the ROW and depth of cover. Early consultation between the developer and the pipeline operator should expedite the urban development process in such matters as: identifying the exact location of a pipeline, developing crossing agreements, revising easement agreements, and initiating minor alignment changes to pipelines should relocation be determined to be advantageous. A bottleneck in any of these matters could unduly extend the time for subdivision and development approvals. Consultation between the municipality and the pipeline operator during the preparation of statutory plans would also provide for an opportunity of integrating the pipeline ROW with future urban development.

A number of planning authorities have developed a contact list of pipeline companies operating within their jurisdiction. They have found it useful to develop a referral system for a range of matters including: setback distances, acceptable surface uses for the ROW, and whether changes to product transmission have occurred.

SECTION 2

TECHNICAL SUPPLEMENT



SECTION II: TECHNICAL SUPPLEMENT

I. INTRODUCTION

1. Purpose

The purpose of the technical supplement is to provide additional technical detail for the land use planning authorities and other concerned and affected parties, both private and governmental. As such, the supplement should serve not only as a background to the advisory land use planning notes, but also as a reference source on a range of matters relating to pipelines and land use. It is anticipated that the supplement will serve as the technical basis for tailoring appropriate solutions for the encroachment problem to the local situation.

2. Content

The supplement focuses principally on the land use planning aspect of the encroachment problem. The central planning issues which have been identified as requiring resolution and which are discussed in some detail include:

- protection of the urban fringe;
- land use planning agency participation in ERCB hearings;
- subdivision referrals to the ERCB and consultation with pipeline operators;
- the use of data bases on pipeline location;
- pipeline relocation;
- development setbacks and appropriate adjacent land uses to pipeline ROWs; and
- design principles for integrating pipeline ROWs with urban development.

The supplement also outlines the various measures that have been introduced by the ERCB to reduce risks to the safety of adjacent populations and to ameliorate land use conflicts between pipeline ROWs and urban development.

3. Organization

The technical supplement is divided into four parts:

- Part I is the introduction;
- Part II provides an overview of the pipeline-urban encroachment problem;
- Part III outlines the measures that have been implemented by the ERCB to control third-party damage; and
- Part IV identifies the land use planning issues which revolve around the encroachment problem.

II. AN OVERVIEW OF THE PIPELINE-URBAN ENCROACHMENT PROBLEM

The pipeline-urban encroachment problem generally revolves around the interplay of two factors: safety, and urban development pressure and the associated land use conflicts. At a general level, the problem is due to the location of a pipeline in close proximity to an urban area. As a result of population growth, urban development eventually engulfs the pipeline. This development process creates two key concerns:

SAFETY - How to ensure that the existence of the pipeline will be compatible with the population and land uses adjacent to it. How to ensure that the integrity of the pipeline is adequately protected from being damaged during and after the urban development period; and

LAND USE CONFLICTS - What must be done to integrate the pipeline ROW into the urban development in order to minimize fragmentation of land use and to reduce the planning and development costs.

Figure 1 identifies some of the key aspects of the pipeline-urban encroachment problem. Focussing on the timing and spatial dimensions, it shows the stages at which the problem develops, and the types of issues which could surface at the regional, municipal and site-specific levels. The problem is linked to:

- **insufficient attention being given to a preventative approach which would limit pipeline construction in areas preferred for urban expansion;**
- **an insufficient understanding of the safety implications of various types of products which pipelines transmit; and**
- **a lack of planning for the integration of pipelines with urban development.**

Figure 2 illustrates that a number of agencies; namely the ERCB, the Alberta Planning Board, regional planning commissions, and municipalities have planning and management responsibilities with respect to pipeline-urban encroachment issues. None of the agencies, however, has exclusive responsibility for resolving all the issues. A successful treatment of the issues, many of which are inter-related, requires a commitment, active involvement, and co-operation of a number of the actors, and the selective application of a range of techniques and planning instruments. For example, the general municipal plan, the area structure plan, the land use by-law can be employed to aid the pipeline applicant and the ERCB in selecting pipeline routes and to integrate the pipeline ROW with urban land uses in a safe, economical, and attractive manner. The extent to which the planning instruments can be successfully applied will depend on a number of factors including:

Figure 1: Common Pipeline - Urban Encroachment Problems

	Planning	Pipeline - Urban Development
Regional	● Infrequent or inconsistent involvement by regional planning commissions in representing land use concerns at ERCB hearings ● Location of pipeline in areas subject to urbanization pressures ● Alignment of pipeline ROW's fragment lands	● Potential for encroachment problems to develop is frequently not explicitly considered by pipeline applicants
Municipal/Community	● Municipality lacks knowledge about safety implications of pipeline and impact on future land use, hence the failure to make provisions for integration of pipeline with future urban development in municipal plans	● Municipality requires developer to realign pipeline, dedicate ROW or adopt other measures, thereby increasing the cost of development ● Municipality too permissive (or too restrictive) towards development of land abutting pipeline ROW by permitting inappropriate adjacent land uses ● Lack of consultation between municipalities and pipeline operators with respect to acceptable surface uses of ROW's
Site Specific	● Subdivision referrals to ERCB do not include all hazardous pipelines ● Pipeline company fails to recognize urban development potential of area, and does not incorporate more stringent pipeline design standards	● Lack of frequent warning signs along pipeline ROW's ● Construction activities may rupture pipeline through lack of knowledge of pipeline location

Figure 2: Present Institutional Arrangements For Managing Pipeline - Urban Encroachment Issues

MAJOR ACTORS AND LEGISLATION		Mandate	Policy, Planning, Regulatory Instruments	Role of Instruments
	ERCB (Pipeline Act)	• has quasi-judicial and regulatory functions to ensure economic and orderly development of pipeline facilities and their safe construction and operation	• Pipeline Regulation	• sets out approval process for pipeline projects • controls routing of pipelines • regulates pipeline standards, construction, operation, maintenance, repair and abandonment procedures • regulates ground disturbance within 30 metres of a pipeline
	APB (Planning Act)	• oversees the land use planning system • provides policy guidelines to regional planning commissions and municipalities • approves Regional Plans and amendments • decides on subdivision appeals	• Framework for Application of Regional Plan Guidelines • Subdivision Regulation	• provides direction on preparation of Regional Plans • requires Regional Plans to protect regionally-significant utilities from encroachment • provides for a setback between a sour gas pipeline and a subdivision • provides for referral to ERCB in subdivision approval process
	RPCs (Planning Act)	• develop Regional Plans • provide planning services to municipalities • act as a subdivision approving authority	• Regional Plan	• contains policies dealing with regionally-significant utility corridors and guides municipalities on the implementation of the regional policies
	Municipalities (Planning Act)	• manage development through the issuance of development permits • enter into agreements with developers in the development/subdivision approval process	• General Municipal Plan • Land Use Bylaw • Area Structure Plan	• largely concerned with physical development (e.g. location of different types of land use, direction of future growth, location of utility servicing) • regulates the density, and use of land and buildings in a municipality • describes the sequence of development, land uses, location of public utilities, etc

- the ability of the plan to describe the direction of urban expansion;
- the technical and economic feasibility of establishing utility-transportation corridors to prevent land fragmentation; and
- the formulation of policy in municipal planning documents to provide for the integration of the ROWs with adjacent land uses in the subdivision design process.

Compared with other conventional modes of transportation (i.e., trucks and railways), the pipeline is generally regarded as the safest and most economical means of transporting oil and gas products over long distances. Depending on the potential hazard of the pipeline, which is largely a function of the type and volume of product it carries, the safety and integrity of pipelines in urban and urbanizing areas can be enhanced by a range of land use related and engineering measures, including:

- relocation of the pipeline;
- deeper burial;
- increased surveillance; and monitoring of construction activities;
- reduction of operating pressure;
- increasing the wall thickness of the pipeline;
- installation of additional block valves at closer spacing to reduce the amount of product that would escape if a break or rupture occurred;
- subdivision and development referrals to pipeline operators and in certain instances to the ERCB;
- imposition of a development setback distance;
- limitation on certain types of land uses adjacent to ROWs;
- unobstructed ROWs for easy access and rapid response in the event of an emergency; and
- clearly defined ROWs with frequent warning signs.

The last point should not be under-emphasized. If the ROW is clearly defined, and warning signs are appropriately placed and maintained, the chance of the pipeline being damaged during construction activity due to the lack of awareness by the public or construction personnel will be significantly lessened. This measure is the simplest to implement both in terms of cost and technical feasibility. It should be noted that although corrosion is the leading cause of leaks, third-party damage is particularly significant because the break mode is usually a rupture (i.e., a major pipe opening). A rupture immediately impairs the operation of a pipeline and can cause significant damage.

III. ERCB INITIATIVES

The ERCB, in keeping with its mandate as the key Provincial regulatory agency for product pipelines, initiated a number of actions aimed at keeping the problem of third-party damage under control.

First, the Pipeline Act and the Pipeline Regulations were amended to provide for tighter control of construction activities on and around pipeline ROWs. The amendments require:

- notification of the pipeline company by anyone contemplating construction activities within 30 metres of the pipeline ROW;
- the accurate location and identification of the pipeline in the field by the person intending to carry out a ground disturbance;
- the use of hand-exposure methods, for excavation activities conducted within 5 metres of the pipeline;
- temporary fencing of the pipeline ROW to limit access of heavy equipment in certain justifiable circumstances;
- the suspension or shutting down of construction activities by the ERCB where it appears that the integrity of the pipeline may be compromised; and
- the reporting of any external damage to the pipeline company immediately after its occurrence.

Second, since some of the above measures require an improved information system, private sector initiatives and provincial encouragement is resulting in the development of a one-call system. The Alberta One-Call Location Corporation was formed to provide a single toll-free telephone number for use by contractors, utilities, public agencies and private citizens. The objective is to have 80 to 90 percent of all underground facilities, both in urban and rural areas, on-line by the latter part of 1985. Once in operation, the system will notify operators of underground facilities of the intent to excavate or disturb the ground surface, who can then send personnel to locate the lines and monitor disturbances. The rationale for the Corporation is that similar systems elsewhere have reduced third-party damage by 20 to 60 percent.

Third, provisions are in place which require companies that operate high vapour pressure pipelines in urban areas to upgrade their lines retroactively, in accordance with the provisions of Canadian Standards Association standard Z183-1977 "Oil Pipeline Transportation Systems". The standards included in Z183-1977 introduce the concept of "zones" based on population density, and call for higher design factors/performance standards for pipelines traversing densely populated urban areas. Equivalent measures can include deeper burial and lowering of the operating pressure.

Finally, the ERCB supports several measures which should, in the long run, benefit land use planning. For example, the Board:

- supports joint use of pipeline ROWs where practicable, in order to reduce the land use impact;
- requires pipeline applicants (with the exception of gas distribution lines operating at a pressure of 700 kPa or less) to contact urban municipalities and furnish proof that planned pipelines will not conflict with urban development, before granting a pipeline permit; and
- favours maintaining ongoing communication with planning agencies to discuss planning concerns; to explain pipeline records that are available, and to explore mutually acceptable solutions to the pipeline-urban encroachment problem.

IV. LAND USE PLANNING ISSUES

Frequently, the focus of planning authorities, in dealing with pipelines, is to limit risks to safety and property damage. This approach tends to favour, in some instances, the use of restrictive controls (e.g., imposition of development setbacks) as a principal method for limiting development adjacent to pipeline ROW's. However, safety is only one component of the pipeline-urban encroachment problem. A number of complex issues should be addressed in developing a planning solution, as discussed below. These issues include:

1. the protection of the urban fringe;
2. land use planning agency participation in ERCB hearings;
3. subdivision referrals to the ERCB and consultation with pipeline operators;
4. the use of data bases on pipeline location;
5. pipeline relocation;
6. development setbacks and appropriate adjacent land uses to pipeline ROWs; and
7. design principles for integrating pipeline ROWs with urban development.

1. Urban Fringe

Under Interim Directive (ID) 81-4, the ERCB requires an applicant for a pipeline permit to include in the application, a statement that the applicant has advised the urban municipality of the intent to apply to construct a pipeline, and whether or not the municipality has any objections to the application. The requirement applies to proposed pipelines within 1.5 km of the corporate limits of an urban municipality, but does not include gas distribution lines that will operate at 700 KPa or less.

The ID is used as a medium for negotiation (and may avoid the need for a hearing for smaller projects). It also provides a mechanism whereby potential pipeline-urban encroachment problems may be prevented or mitigated beforehand. Should a municipality have an objection to the routing, the ERCB will provide assistance in negotiating a route or alternative routes which would accommodate municipal concerns. The key point to note is that the municipality must make the effort to reply, otherwise the process to resolve the issue is not initiated. Thus the degree of attention which planning authorities provide in replying to an ID 81-4 referral may have implications as to whether at a future date municipalities will have to concern themselves with the development constraints imposed by pipelines. In this regard, the municipal reply must be specific to be useful since only then can it act as a basis for negotiation.

Furthermore, pipeline companies are receptive to discussing their proposal to avoid delays or risk an ERCB decision not to approve the application. If an agreement on pipeline location cannot be reached between the municipality and the pipeline applicant, a hearing would be initiated by the ERCB.

The ERCB decision on whether a pipeline will be located in the urban fringe will depend on a number of factors including:

- type of pipeline (i.e., low or high hazard);
- the economic life of the pipeline in relation to the projected time-period for urbanization; and
- the case that the municipality can make at a hearing that the affected area is the preferred location for urbanization.

The intent of the ID 81-4 was to provide a mechanism to address the pipeline-urban encroachment problem. However, in general, a number of logistical and planning problems exist which frequently limit the effectiveness of the mechanism:

- the referral may be made to an individual in a municipality without the necessary expertise;
- municipalities may not have developed criteria upon which to base a reply, and as such replies are too general or too inflexible to be useful for negotiation purposes;
- municipalities may not seek the advice or assistance from their regional planning commission; and
- municipalities may not have developed a long-term growth strategy with which to evaluate proposals beyond their present boundaries, and as a result, do not bother to reply.

2. Land Use Planning Agency Participation in ERCB Hearings

The hearing process would be initiated when an applicant seeks the approval of the ERCB for the development of a major pipeline project (regardless of whether or not an agreement between a municipality and a pipeline company was reached); and with respect to smaller projects, when an agreement between a municipality and a pipeline company could not be reached. Land use planning agencies are entitled to make representations to the ERCB on the land use implications of the application. A failure to make a representation at a hearing would not necessarily preclude the ERCB from considering land use planning matters. Should a planning agency not appear, ERCB solicitors would question the applicant based on the municipality's reply as provided for under ID 81-4. Nevertheless, in cases where one or more of the routing alternatives proposed by an applicant traverses the urban fringe, the presence of a planning agency would provide it with the opportunity to question the applicant, identify an appropriate alternative, and provide explanations and clarification; and thereby enhance the ERCB's information on matters upon which it must render a decision.

Planning agencies do not participate in the hearings regularly, and as a result, land use issues sometimes are not fully brought to the attention of the ERCB. There are a number of reasons for the lack of a consistent approach by planning agencies to intervening at ERCB hearings including:

- no position has been developed as to what circumstances would warrant a submission;
- lack of awareness that a hearing has been scheduled (for major pipeline applications, a notification of hearing would be provided to regional planning commissions because they are considered to be an interested party);
- in certain instances, a regional planning commission may not have received a request from a municipality to represent its interests; and
- the staff resources necessary to develop a submission are unavailable because of other priorities.

Whatever the reasons that may apply in any given instance, a failure to advance concerns, as well as solutions and mitigative measures at a hearing is an incomplete response to resolving the pipeline-urban encroachment problem.

3. Subdivision Referrals and Consultation with Pipeline Operators

The Subdivision Regulation provides separation distances between different types of proposed uses and existing sour gas facilities. The subdivision approving authority is required to send a copy of a subdivision application to the ERCB, if the affected parcel is situated within 1.5 km of a sour gas facility (including pipelines). The ERCB furnishes the subdivision approving authority with the classification of the sour gas facility, and thereby advises on the appropriate separation distance as provided in Schedule 6 of the Regulation. The ERCB will also scan for other pipelines in the vicinity of the proposed subdivision and will bring to the subdivision approving authority's attention the location of any HVP or large diameter/high pressure hydrocarbon pipeline. It should be noted that the provisions dealing with sour gas provide the only formal requirement for subdivision referrals to the ERCB.

The ERCB has not provided subdivision approving authorities with maps which would identify the location of sour gas facilities. The reason is logistical, in that given the level of exploration and development, such maps would need to be continually updated. Since the subdivision approving authorities are not fully aware of the location of sour gas facilities, a significant portion of the required referrals are not circulated to the ERCB for comment. The ERCB's tentative plan to rectify the problem is to supply the subdivision approving authorities with maps that delineate sour gas fields since the vast majority of the facilities would be located within those areas.

The practice among at least several subdivision approving authorities is to refer applications for comment to pipeline companies that have registered their easement in the certificate of title. One of the problems with relying totally on certificates of title to ascertain whether a pipeline traverses a given area is that only relatively recently has it become standard practice to register pipeline easements. Thus, the older the certificate of title, the less reliable it is in terms of identifying the existence of pipelines; and as such should not be totally relied upon. However, it should be noted that pipeline companies are open to consultation with land use planning agencies. It is in their interest to do so because pipeline companies are concerned about third-party damage and encroachment directly affects their operations. Consultation benefits planning agencies in respect of such matters as identifying appropriate surface uses for the pipeline ROW.

4. Data Bases on Pipeline Location

The ERCB records fall into two categories:

- pipeline township drawings (available either on microfiche or photocopy) which show, by township and range, the approximate location of all pipelines licensed by the ERCB; and
- a selection of maps which identify the main oil and gas pipelines.

Unfortunately, the pipeline township drawings would require in some cases that planning authorities transcribe the drawings onto master maps suitable for planning purposes, while the small scale of the maps which identify the main oil and gas pipelines do not provide sufficient detail. Nevertheless, the use of available ERCB records can aid in identifying: the approximate location of pipelines as well as the products being transmitted, the operating pressures and diameters of the pipelines, and the pipeline operators. As such, the use of the records can serve not only as a "red flag" for a range of planning activities, but also in identifying whether a referral to the ERCB is warranted. This has been recognized by a number of planning authorities which subscribe for updates to the township drawings either on an annual basis or as frequently as changes to the drawings are made.

5. Pipeline Relocation

A relocation of a pipeline may be achieved in several ways, including:

- negotiation between the developer and the pipeline company, or
- an application by a developer or municipality to the ERCB for a pipeline relocation order.

If the interested parties can reach an agreement among themselves, the ERCB would only become involved by issuing a pipeline permit. If a relocation order was requested under the Pipeline Act, the ERCB would become involved in investigating the feasibility and appropriateness of the proposed relocation, and in facilitating negotiations with respect to a cost-sharing agreement between a developer and a pipeline company. If a mutually acceptable cost-sharing agreement cannot be reached, the ERCB, in its adjudicative role, would determine the manner of sharing of the costs involved. In this role, the ERCB adheres to the principle that those that benefit pay the relocation costs. Once the ERCB has issued an order regarding relocation and the assignment of costs, the parties involved are bound by the order and cannot opt out by taking no action.

Outwardly, it may seem that the relocation of a pipeline, away from areas subject to urbanization, offers a feasible solution to the pipeline-urban encroachment problem. Depending on the specific situation, relocation can offer a number of benefits including:

- pipelines would be at less risk to third-party damage as a result of various construction activities;
- reduces or eliminates capital and maintenance costs associated with the upkeep of pipeline ROWs;
- the pipeline company would in many cases avoid potential future costs of upgrading the pipeline (e.g., HVP product lines) once urbanization has occurred;
- reduces the safety risk to the urban population of a pipeline failure or rupture;
- no added expense is incurred by the municipality and developer in planning, designing (e.g., setbacks, landscaping) and servicing (e.g., road crossings) subdivisions around existing pipelines;
- avoids land fragmentation and promotes orderly development (e.g., negates the possibility of an undesirable corridor and buffer strip), and thereby creates more efficient subdivision design;
- recoups the value, partially or totally depending on the circumstances, of vacated lands for urban development, and the use to which such land may be put; and
- increases long-term, land use planning flexibility.

A background study prepared to determine the potential enhancement in market value, as a result of a pipeline being relocated from a subdivision, provides some insight on the cost aspects and the planning implications in areas affected by pipelines and offers the following rule-of-thumb findings:

- in an undeveloped area, relocation of a pipeline ROW will allow the land holder to regain 100% of the market value of the land thus vacated;
- in partially-developed areas, or developed areas in which the pipeline has caused some disruption to the design of land use, relocation of the ROW will recoup 50% of the loss of market value of the land vacated; and
- in fully-developed areas, in which the pipeline ROW has been either accommodated by means of a well thought-out design, or not dealt with at all (i.e., no attempt was made to integrate the ROW), removal of the pipeline ROW would do little to enhance the market value of the ROW.

The planning implications which may be inferred from the foregoing are as follows:

- urban land use economics favour the location of pipeline ROWs away from areas which will be affected by urban development. This requires that areas for urban expansion be identified before hand; and
- while relocation of a pipeline from an already developed area will definitely eliminate the safety concern, very little or no positive impact on land use or the market value of the land vacated will be achieved, unless the abandonment and the reuse of the ROW was foreseen and incorporated into the original subdivision design.

In general, the case against relocation is two-fold:

- pipeline ROWs can be successfully and safely incorporated into subdivisions, and they have the potential for multiple use (e.g., a buffer zone to separate incompatible land uses, passive recreational use); and
- relocation costs can be very high compared to the increased values of vacated lands, and it is difficult to negotiate the proportion of the increased values of the lands which should be applied towards the cost of relocation.

The large capital expenditures required to secure a new ROW and to relocate a pipeline is a very significant constraint which limits wide-spread application. The rule-of-thumb cost for constructing a new pipeline is in the range of \$25,000 to \$35,000/diameter-inch/mile (1984 estimate). Thus to relocate a 4 inch diameter pipeline for a distance of two miles would require an expenditure of between \$200,000 and \$280,000. It is for this reason that when the ERCB requires a pipeline company to retroactively upgrade a pipeline in an urban area, the company will invariably try to reduce the operating pressure, rather than relocate the pipeline or install a new pipeline with increased design standards.

Most pipeline relocations that have taken place to date have been minor realignments of small diameter pipelines. Although a major relocation involves heavy expenditures, it is an option which should not be discounted in all cases. The relocation option has numerous, short- and long-term direct and indirect, benefits and costs. Each specific situation requires an analysis of the benefits and costs associated with the move as well as a willingness on the part of the interested parties to negotiate a cost-sharing agreement.

6. Development Setbacks

The imposition of a setback distance for buildings from pipelines serves a number of purposes:

- provides a means of placing limitations on the proximity of adjacent land uses to the pipeline, and discourages the practice of allowing building lots to be placed over pipeline ROW;
- attempts to limit the potential hazards to residents and structures of a pipeline failure or rupture;
- controls access and curtails surface activities prejudicial to the integrity of pipelines;
- permits access for maintenance and emergency purposes; and allows space for the movement of vehicles or equipment without encroaching on the pipeline; and
- enables unhindered land or airborne surveillance since the pipeline ROW is not visually or physically obstructed.

In view of the hazardous nature (i.e., toxicity) and potential public nuisance aspects of sour gas, the Subdivision Regulation under the Planning Act stipulates specific minimum distance requirements which separate sour gas facilities (including pipelines) from residential and other developments. The distance requirements depend on the potential volume release rate of sour gas and type of proposed land use. The only exception is that there is no stipulation of a specific minimum distance requirement with respect to pipelines with low potential volume release rates of sour gas (categorized as a level I facility). In the case of a level I facility pipeline, the minimum separation distance is the distance between the pipeline and the boundary of the pipeline ROW.

In the case of pipelines that transport other gas or oil products, it is difficult, and probably unrealistic, to determine a single minimum setback distance which would be applicable to all situations. A significant number of variables need to be considered when determining an appropriate setback distance including:

- adjacent land uses (e.g., uses which provide essential emergency services such as fire halls and hospitals need to be located further away from high vapour pressure product pipelines in case of a pipeline failure or rupture);
- level of risk and magnitude of impact (e.g., sour gas is toxic at low concentrations while failures of crude oil pipelines seldom result in an explosion or fire); and
- pipeline design and operating pressure (e.g., the higher the pipeline standards and the lower the operating pressure, the lower the safety risk).

An additional complication with establishing setbacks for pipelines is that the products transmitted can change. Changing supply and market conditions may require that a pipeline originally approved for a product with a low hazard potential be changed to a product with a much higher hazard potential and vice versa. There is no such similar flexibility with respect to setbacks and permitted adjacent uses. As a result, it can be argued that pipelines should be treated as high hazard no matter the present hazard potential, except in cases where a change to a high hazard product is guaranteed not to occur. However, it should be noted that a change in product transmission requires the approval of the ERCB, and consideration is given to the proximity of existing land uses. Furthermore, landowners and the municipality would be notified of an application for a change in the product being transmitted. If objections are raised, a hearing would be held.

The above discussion should indicate that formulating an appropriate setback distance is not only a difficult task, but also to a significant degree requires a subjective assessment of potential risks and impacts.

7. Urban Design

The location of pipeline ROWs may significantly affect subdivision design. Land use planning practice can directly influence the success with which pipeline ROWs and urban development can co-exist. To promote compatible integration of the pipeline ROWs requires a recognition that a potential exists to use the ROW for certain urban uses. A failure to integrate a pipeline ROW in the subdivision design, or a failure to consider aesthetic opportunities or pipeline realignment possibilities can have negative influences upon the area through which it passes.

Provided in Illustrations I through V are selected subdivision examples which illustrate the use, or the lack of use of, a number of urban design principles for integrating urban development with pipeline ROWs. The Illustrations point out that there is no single formula for integrating ROWs with urban development, but rather that a range of measures can be employed, depending on local circumstances.

ILLUSTRATION I

The subdivision illustrates the integration of a pipeline ROW with adjacent development in a compatible and visually pleasing manner. The following design principles are contained in this subdivision example.

- The ROW is used as a pedestrian walkway system, through the centre of the residential area, and as a park space providing access to a park, playground and a neighbourhood commercial centre.
- One segment of the ROW has been incorporated into a playground. While another segment is used for parking purposes. Thus the ROW serves a number of specific land use functions.
- Frequent easy pedestrian access is provided in the ROW via walkways.
- Access is provided to the pipeline ROW for surveillance, maintenance and repair purposes. Should it be necessary during an emergency situation: the vehicles, in the segment of the ROW that is used for parking, can be readily removed.
- The landscaping of the ROW is designed to enhance the park space. The pocket parks abutting the edge of the ROW enhance the lineal attractiveness of the ROW.
- There are a limited number of roads bisecting the ROW. This lessens road crossing costs and provides lineal continuity for the ROW as a community space.
- The lots adjacent to the pipeline ROW are basically perpendicular to the boundary of the ROW, and as such are not bisected by the ROW. Thus adequate building sites are available on the lots, and this will prevent encroachment upon the ROW by other land uses.

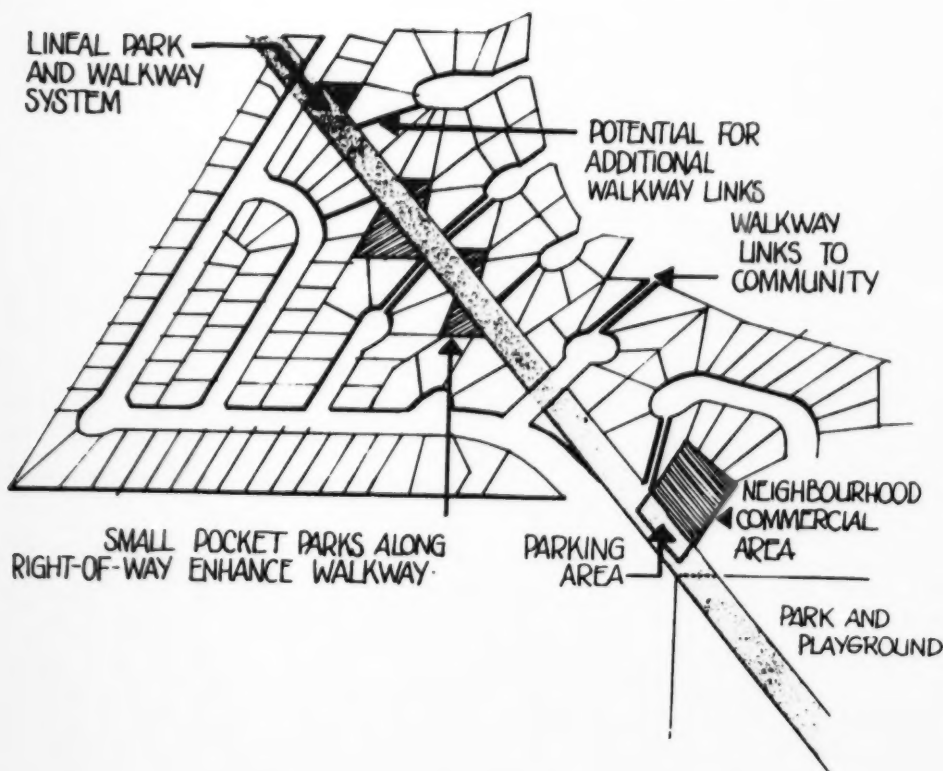


ILLUSTRATION II

In this subdivision example, the pipeline was realigned into a municipal reserve parcel and incorporated as part of the open space system. Some of the benefits of the realignment are as follows:

- The new ROW no longer presents a design constraint to residential development and has a multiple use.
- Certain cost advantages are accrued by the realignment, as for example: there is no need for additional lot depth for setback requirements; the number of road crossings is decreased; and landscaping and maintenance costs are reduced since the park would in any case incur these costs.

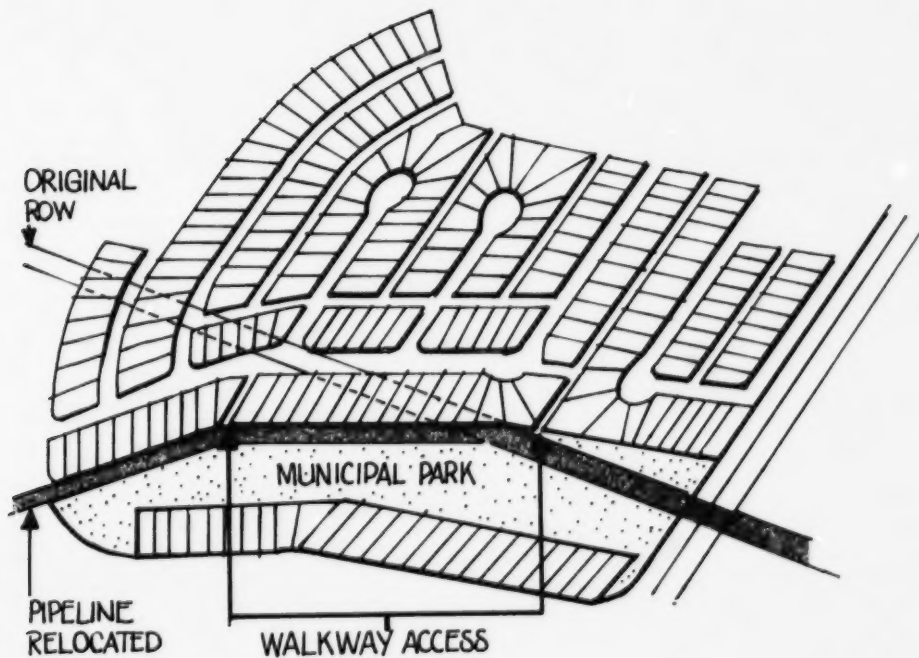


ILLUSTRATION III

This example illustrates the opportunities and constraints which exist when a pipeline corridor (i.e., two or more pipelines) bisect a residential community, and identifies a number of design principles which were, and were not incorporated. The following features should be noted:

- If the pipeline were ever abandoned, the corridor could be subdivided to permit residential infill.
- Although the corridor dissects the residential community and sterilizes a significant amount of land, the fact that the pipelines are consolidated limits land fragmentation elsewhere.
- A rear lane is located between the corridor and the residential subdivision which serves to double-up as part of the setback requirement. A disbenefit of this approach is that the corridor does not become an integral part of the subdivision.
- The residential developments are perpendicular to the boundary of the corridor. There is a clear distinction between the corridor and adjacent development.
- Although not evident from the illustration; fences of different designs, colours and heights separate the rear lot lines of the majority of the properties from the corridor. This treatment does not serve to improve the appearance of the corridor.

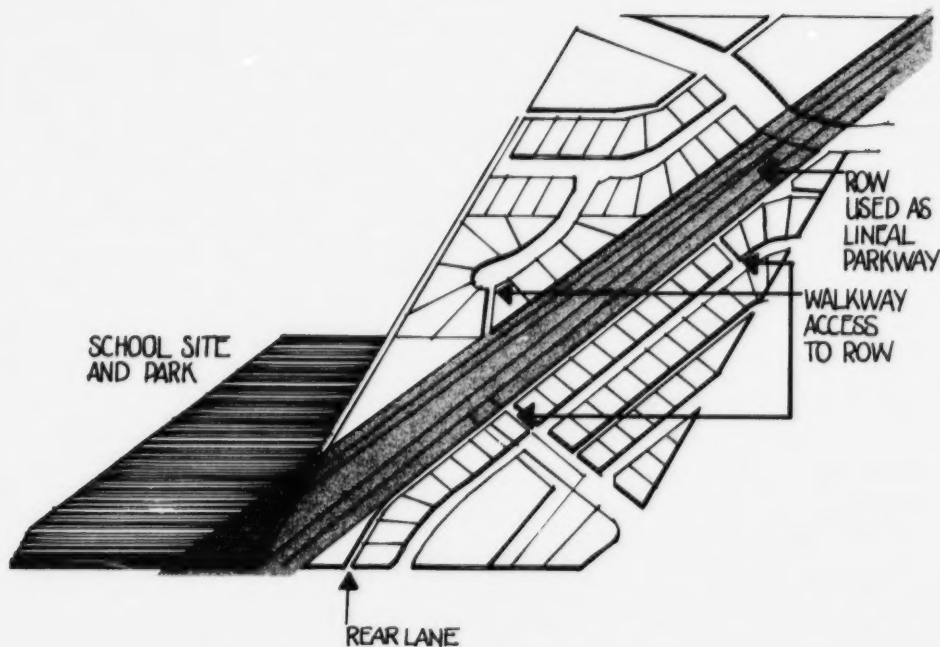


ILLUSTRATION IV

This subdivision example illustrates how pipeline ROWs can be incorporated into industrial lots, and it identifies another way in which ROWs can function within a land use context. Some of the features to note are as follows:

- The lots back onto the ROWs and are designed to allow the ROWs to be incorporated into each industrial parcel. None of the ROWs cross the lots diagonally, which would leave small irregular shaped lots on which to develop. At the same time, it should be noted that pipeline operators have in the past objected to the expansion of industrial lots onto the easements because of concerns with respect to an increased potential for third-party damage.
- Should abandonment of the pipelines occur, it would permit a wider range of uses on each industrial lot.

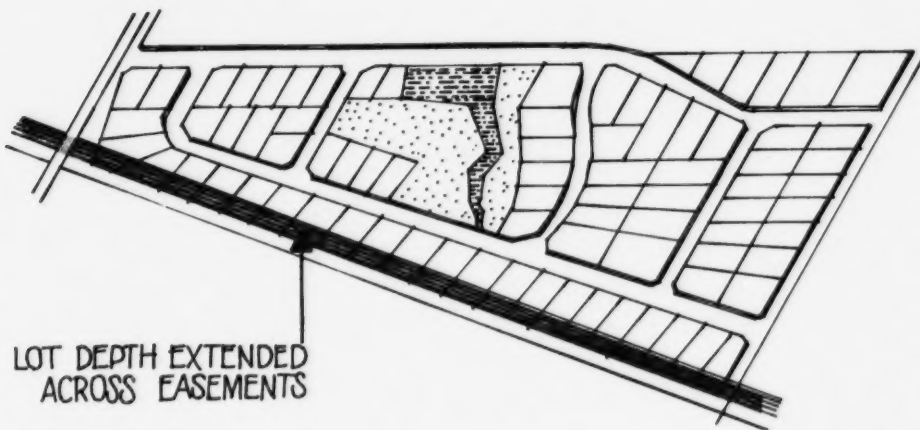


ILLUSTRATION V

This example illustrates how a pipeline establishes a constraint to industrial development. The following features should be noted:

- The subdivision design seems to ignore the existence of the pipeline ROW and does not seem to be concerned with pipeline protection.
- The lot configuration is such that the ROW significantly affects the lot owner's options for a building site and limits the utility of the lot. The lots affected by the ROW are left with small irregular shaped areas on which to develop.
- Should storage be a dominant use, the location of the ROW would not place as significant a constraint as it would initially seem. Such a lot configuration for other industrial and commercial uses would be more inappropriate.

